Swarms of Micro Aerial Vehicles for Active Sensing and Monitoring

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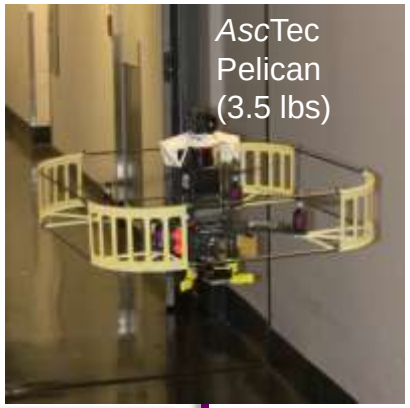
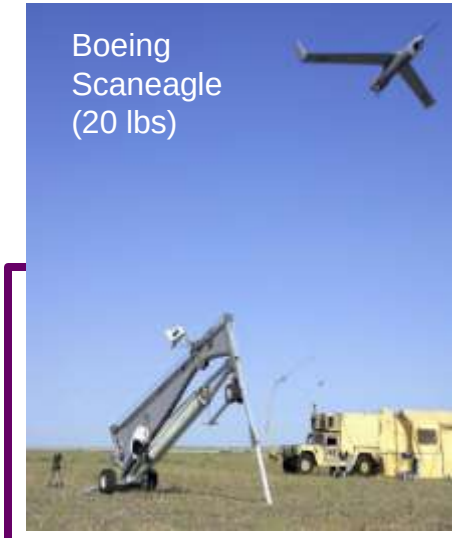
Unmanned Air Vehicles

KMel kNanoQuad
(0.12 lb)

*Asc*Tec
Hummingbird (1 lb)



*Asc*Tec
Pelican
(3.5 lbs)



Boeing
Scaneagle
(20 lbs)

Gen. Atomics
Predator (2,250
lbs)

Gen. Atomics MQ-9
Reaper (10,000 lbs)

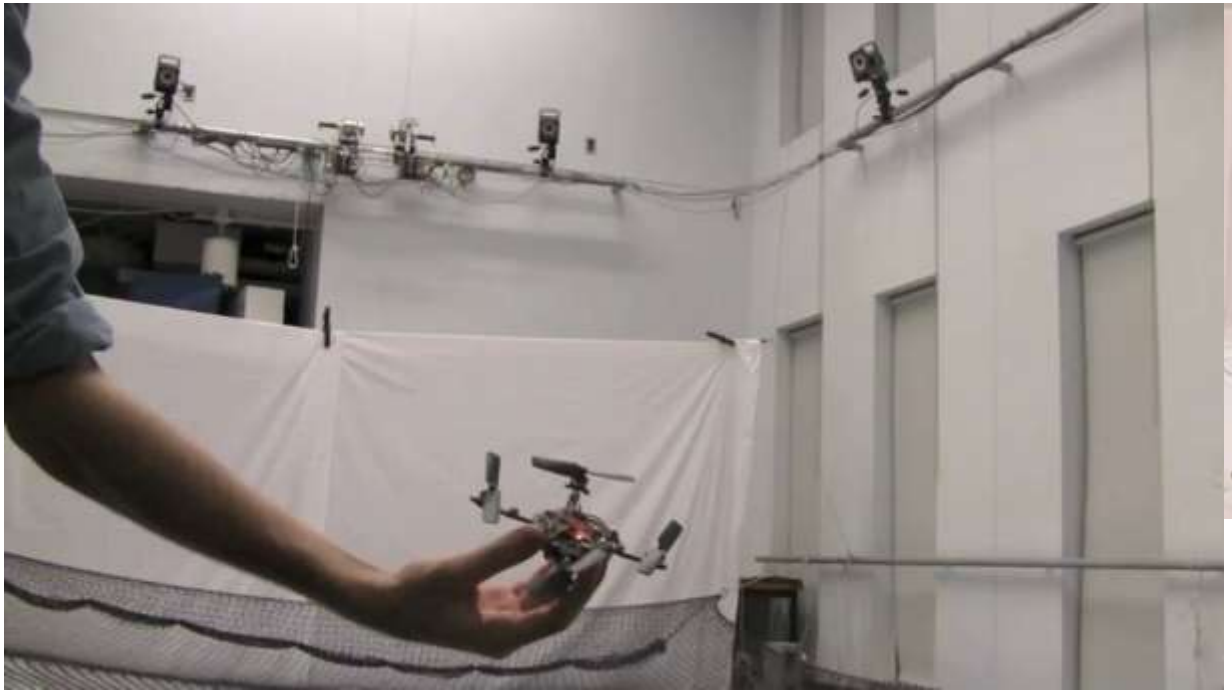
Northrop-Grumman
Global Hawk
(32,200 lbs)

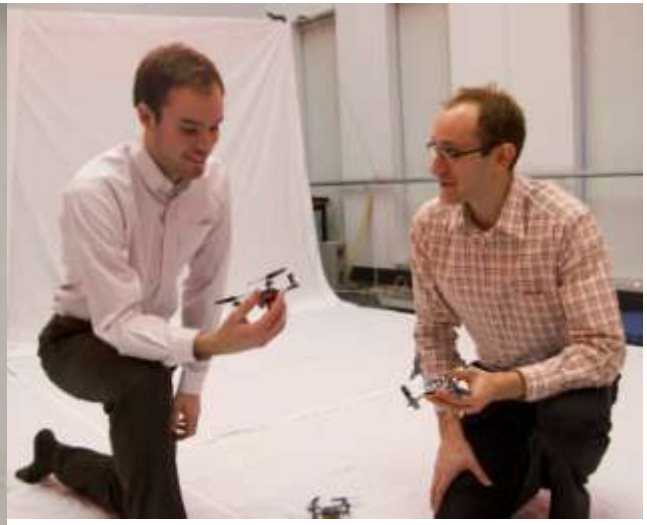
0 1 10 100 1,000 10,000 100,000

Mass

Images from www.af.mil

KMel Robotics

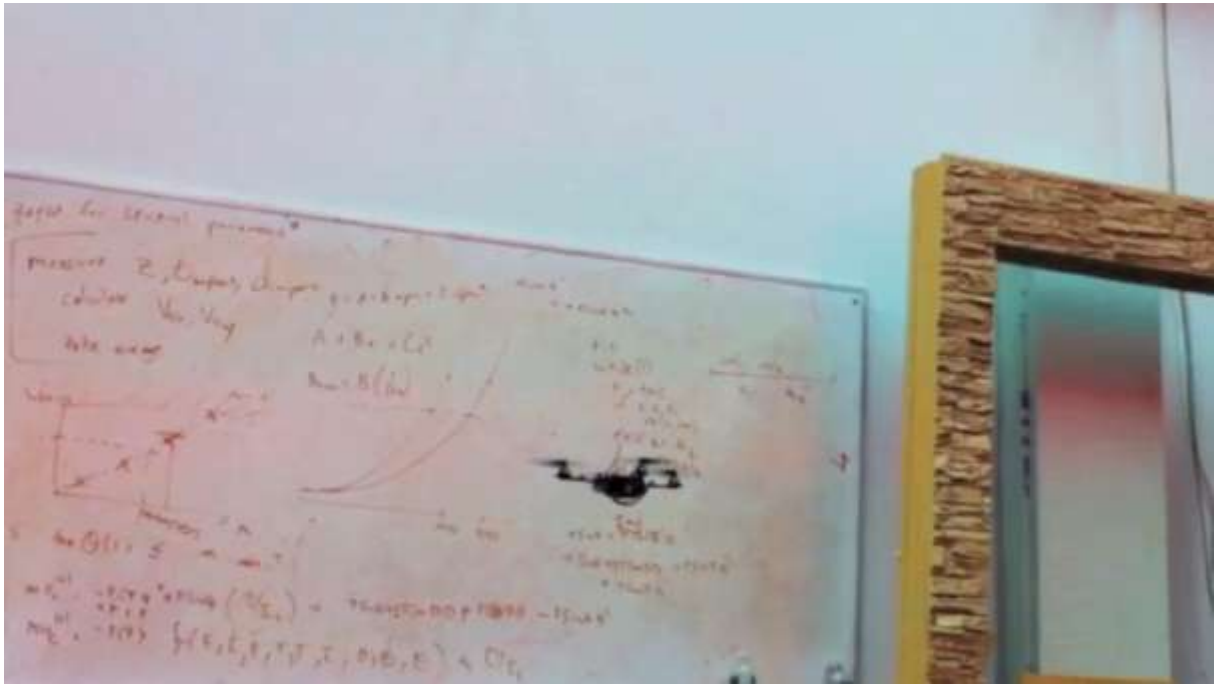


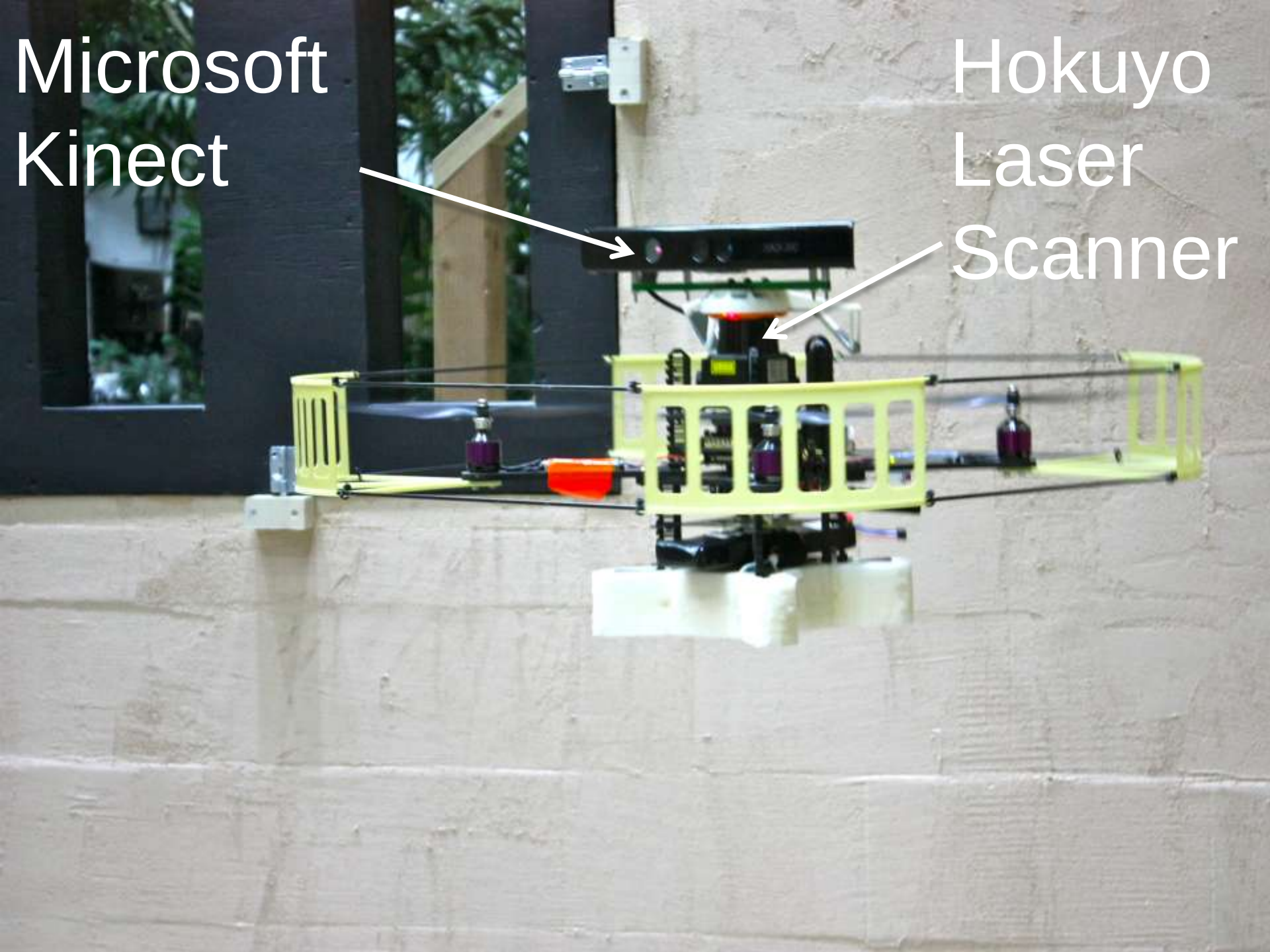


Alex Kushleyev

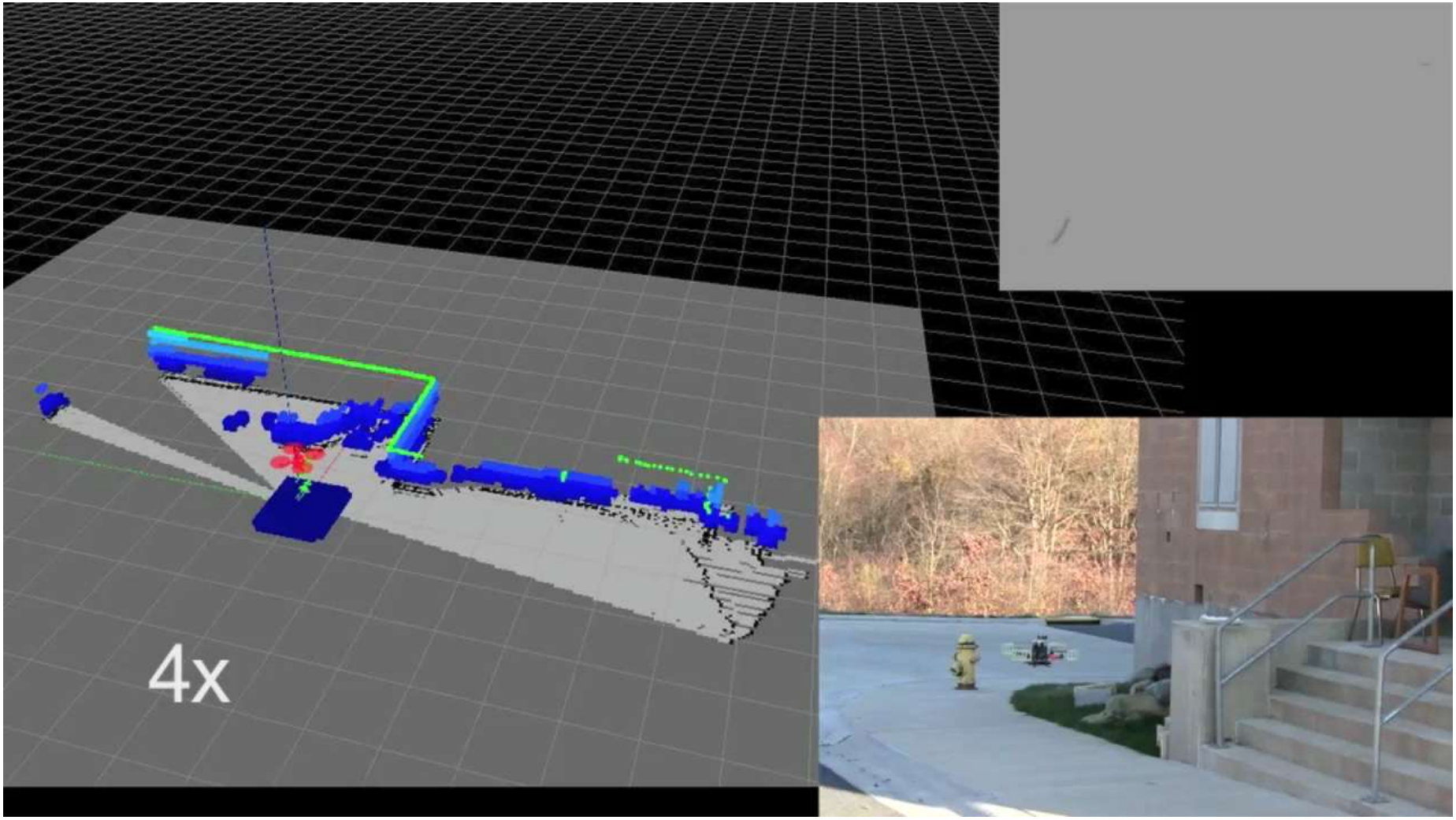
Daniel Mellinger

KMel Robotics




Microsoft
Kinect
Hokuyo
Laser
Scanner

Application: Mapping

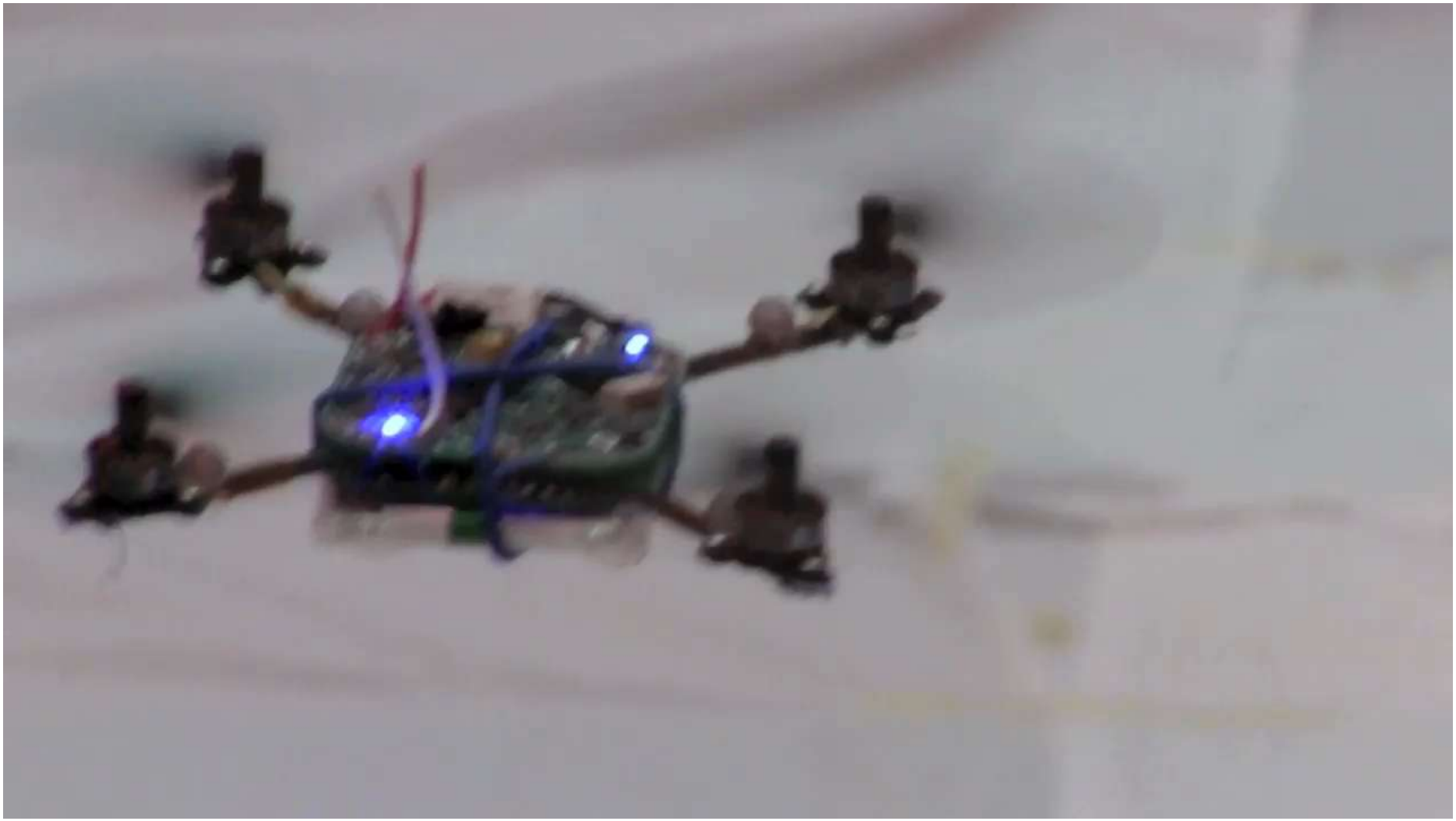


[*Shen, Michael, and Kumar 2011*]

Bio-Inspired Group Behaviors

Penn Engineering

Group Behaviors

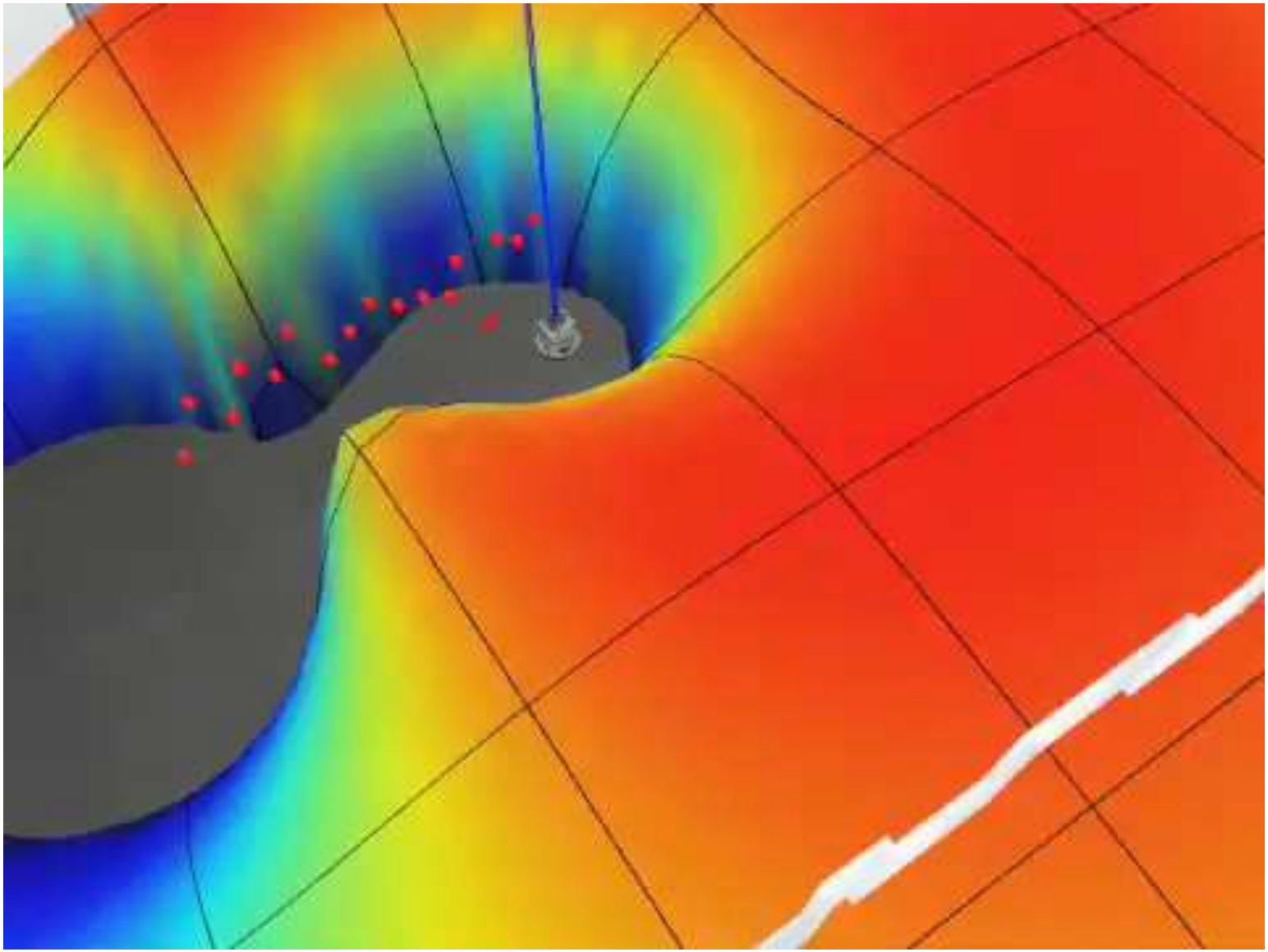


[*Kushleyev, Mellinger and Kumar* 2012]

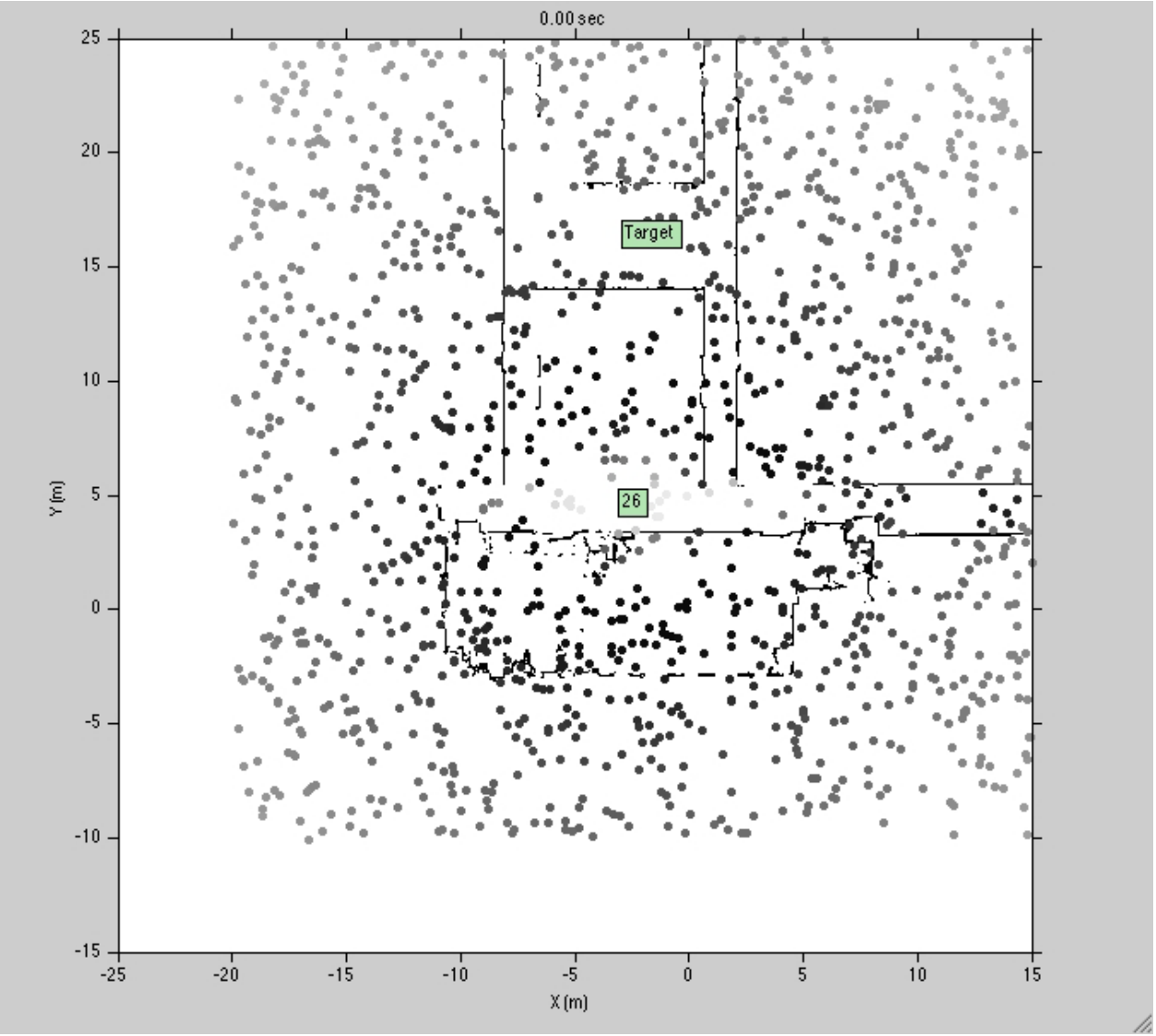
Application: Active Sensing and Monitoring

- Make measurements
- Adaptive spatio-temporal resolution
- Estimate gradients
- Control policies that maximize information
- Develop 4-D maps

Blind Source Localization



Multi Robot Localization



Summary

- Agile, small, aerial robots
- Active sensing and monitoring
- Mapping near plants, landfills, pipelines
- Measurement of environmental conditions